Value-Based Service
From Usage Viewpoint to Functional Viewpoint

Toru Ishikuma
Germany-Japan Cooperation Expert
Chief Automation Standardization Officer, Azbil Corporation
One usage scenario under discussion in Germany-Japan cooperation project

“Condition Monitoring for early fault detection, rapid fault isolation and/or recovery”

- **Engineering & setup**
  1. Connection of a machine
  2. Reconfiguration of a machine
  3. Development of an analysis algorithm

- **Operation & reconfiguration & maintenance**
  1. Collection and analysis of usage data of a machine
  2. Recording additional data on spontaneous request
  3. Operation of a service platform
  4. Generation of recommendations resp. requests for action
  5. Benchmarking of machines
  6. Execution of recommendation resp. request for action

9 activities identified
Blue are core activities
## Activities in Usage Viewpoint

- **Engineering & setup**
  1. Connection of a machine
  2. Reconfiguration of a machine
  3. Development of an analysis algorithm

- **Operation & reconfiguration & maintenance**
  1. Collection and analysis of usage data of a machine
  2. Recording additional data on spontaneous request
  3. Operation of a service platform
  4. Generation of recommendations resp. requests for action
  5. Benchmarking of machines
  6. Execution of recommendation resp. request for action

## Technical steps in Functional Viewpoint

- **Operation & reconfiguration & maintenance**
  1. Data collection
  2. Data analysis
  3. Fault detection
  4. Fault isolation
  5. Maintenance planning
  6. Maintenance execution

To identify what standards to be used and/or developed, functional and technical assessment is needed.
Example actors in Functional Viewpoint

- Manufacturer
  - Time window for maintenance
  - Timing of maintenance
  - Maintenance Scheduler (MS)
  - Machine (M)
    - Maintenance Engineer (ME)
- Production Scheduler (PS)
- In-house Analyst (IA)
- External Advisory (EA)
  - Diagnosis result
  - Diagnosis based on model
- Platform (P)
  - Diagnosis request
  - State
- Machines Worldwide (M)
  - State

To be redefined with Usage Viewpoint
Chronological transaction between actors

Machine

In-house analyst

Machines worldwide

Platform

External advisor

Production scheduler

Maintenance scheduler

Maintenance engineer

1-1. State data generation

1-2. State data

1-3. State data

2-1. Data analysis

2-2. Request for diagnosis

3-1. State data

3-2. Data analysis with expertise

3-3. Result of diagnosis

3*-1. Machine model

3*-2. Analysis with model

3*-3. Result of diagnosis with model

4-1. Production scheduling

4-3. Time window for maintenance

5-1. Maintenance scheduling

5-2. Request for maintenance and its timing

5-3. Maintenance execution

To be redefined with Usage Viewpoint
<table>
<thead>
<tr>
<th>Req No.</th>
<th>Related steps</th>
<th>Requirements name</th>
<th>Requirements description</th>
<th>Candidate standards</th>
<th>Gaps</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1-1</td>
<td>Machine data preparation</td>
<td>Machine shall provide vendor independent interpretation of own state, especially, for planning and management usages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1-3</td>
<td>Data transfer with privacy (non-functional)</td>
<td>The system shall allow distribution of information collected from machines while protecting the privacy of machine users.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5.1</td>
<td>Integrated schedule representation</td>
<td>Both production and maintenance planning systems shall use a common representation various activities and events occurred to in a factory.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Gaps to be analyzed with modeling and standard mapping

<table>
<thead>
<tr>
<th>Req No.</th>
<th>Related steps</th>
<th>Requirements name</th>
<th>Requirements description</th>
<th>Candidate standards</th>
<th>Gaps</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Machine data preparation</td>
<td>Machine shall provide vendor independent interpretation of own state, especially, for planning and management usages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1 - 3</td>
<td>Data transfer with privacy</td>
<td>The system shall allow distribution of information collected from machines while protecting the privacy of machine users.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5.1</td>
<td>Integrated schedule representation</td>
<td>Both production and maintenance planning systems shall use a common representation various activities and events occurred to in a factory.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Thank you